

INVESTIGATION OF WATER WELL INTERFERENCE NEAR GLENCOE, TOWNSHIP OF EKFRID, MIDDLESEX COUNTY

HYDROGEOLOGY OF THE GLENCOE
SOUTHEASTERN WELL FIELD

May, 1976

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D. A. McTavish
Director
Southwestern Region

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ONTARIO MINISTRY OF THE ENVIRONMENT
SOUTHWESTERN REGION
Technical Support Section

INVESTIGATION OF WATER WELL
INTERFERENCE NEAR GLENCOE,
TOWNSHIP OF EKFRID,
MIDDLESEX COUNTY

HYDROGEOLOGY OF THE GLENCOE
SOUTHEASTERN WELL FIELD

by

Blagoje Novakovic

May, 1976
LONDON

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SUMMARY

The study area is overlain by deposits of lacustrine clay and hardpan which are over 125 feet in thickness. The aquifer material is comprised of a lenticular-shaped sand and gravel deposits of limited lateral extent and thickness. They are found near, or immediately above bedrock which consists of grey and black shales of Paleozoic Age. Hydrogeologically these shales may be classified as an aquitard.

Groundwater withdrawals by the Glencoe municipal wells in the area have caused a severe decline of the piezometric surface associated with the buried overburden aquifer system. Thus, a relatively extensive composite cone of depression was created which caused a water level decline in the Nagy drilled well. This occurred because; (a) the pumpage from the Glencoe wells surpassed natural groundwater recharge in the area, (b) relatively good hydraulic communication exists between the Nagy drilled well and the municipal well(s), and (c) the Nagy drilled well is relatively close to the municipal wells.

Vertical leakage through poorly permeable lacustrine clay and hardpan is the main form of aquifer recharge, and precipitation is the chief source of it. Hence, groundwater recovery is very slow, and the present water levels in the municipal wells and the Nagy drilled well are between 83 and 97 feet - approximately three times the original static water levels.

INTRODUCTION

Background

Mr. G. Nagy, lot 22, Gore Concession, Ekfrid Township, owns two wells - a dug well 65 feet deep, located near his residence and a 4 inch diameter drilled well about 1000 feet away, located at his old barn.

According to Mr. Nagy water shortage in his drilled well began in 1967, three years after the operation of Glencoe municipal well No. 7 commenced. As a result he had to lower the pump intake a distance of two pipe-lengths (about 40 feet) but this did not solve the water shortage in his well which was basically used for stock watering purposes.

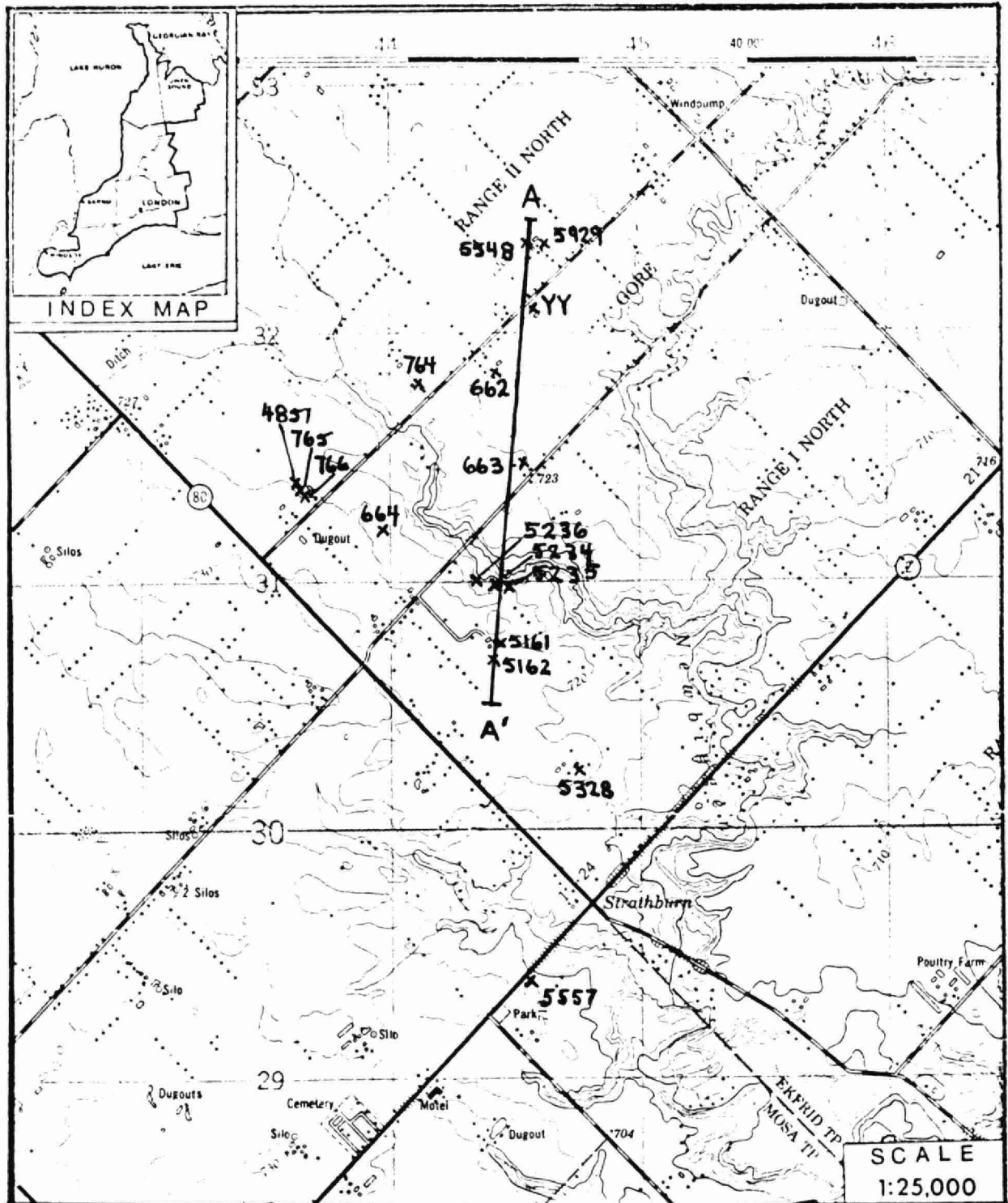
Mr. Nagy has reported on several occasions his concerns that the operation of Glencoe municipal well No. 7 has interfered with his domestic well(s). Subsequent to his first complaint in 1971, the Ontario Water Resources Commission undertook an investigation into this matter (Small, 1971). It was concluded at that time that prolonged pumping of Glencoe municipal wells (Nos. 5, 6, and 7) had caused severe aquifer dewatering and lowering of the piezometric surface in the general area and had interfered with the Nagy drilled well. It was therefore, recommended that the Village of Glencoe should bear the cost of lowering the pump intake in the Nagy drilled well, but the cleaning of this well should be done at the owner's expense (Small, 1971).

It was also concluded in a later investigation (Ontario Ministry of the Environment 1971-1975) that the lowering of water level in Mr. Nagy's bored well had not been caused by the operation of Glencoe municipal wells in the area.

The interference complaint of the Nagy drilled well was raised again on July 14, 1975. The following day the well site and the area was visited by Mr. B. Jaffray of this office who gathered pertinent information concerning this problem. On that day, the Marsh Well Drilling Company rig was at the well site. On the previous day they had pulled the pump and rods out of the well, and cleaned the well. They found that the pump intake was at the depth of 105 feet, and reported that about 4 feet of gravel and sand was bailed out from the bottom of the well. The final depth of the well was measured to be 146 feet.

The Marsh Well Drilling Company also performed a bailer test at rate of 1.0 gpm. After bailing ceased, the water level recovered 15 feet after 5 minutes indicating a poor well yield. On July 17, 1975 the water level in this well was at a depth of 86.2 feet below ground surface. Since then, water levels in this and other surrounding wells have been measured periodically (Table 1).

Since no driller's log is available for this well, it was logged on September 11, 1975, when natural gamma ray and single point resistivity logs were obtained (Appendix B). These logs were used for an interpretation of lithology in this well which is illustrated in Figure 2.



L E G E N D

- | | |
|---------------|---|
| x 4851 | Location and water well number, ^{well} record on file with MOE |
| A'—A' | Cross-section location |
| 766 | Glencoe municipal well (old) no. 5 |
| 4851 | Glencoe municipal well (new) no. 5 |
| 664 | Glencoe municipal well no. 6 |
| 663 | Glencoe municipal well no. 7 |
| 5557 | Glencoe municipal well no. 8 |
| YY | G. Nagy drilled well (interference complaint) |

FIGURE 1. LOCATION MAP

Prior to the start of the operation of Glencoe municipal well No. 7 Mr. Nagy made an agreement with the Village of Glencoe. This agreement stated that if the wells on his property were to fail due to the operation of municipal well No. 7, the Village of Glencoe would be obliged to install a water line to Mr. Nagy's home and barn. It is likely that Mr. Nagy may also be able to obtain satisfaction through the courts using this agreement.

Location

The study area is located in Ekfrid Township, Middlesex County, about 30 miles southwest of London. The land surface is essentially flat, with the exception of up to 30 foot deep gullies formed by the tributaries of Newbiggen Creek (Figure 1).

The location of the Glencoe municipal wells and domestic wells in this area for which records are available are shown in Figure 1. A summary of these well records is provided in Appendix A. Well numbers referred to in the text figures are those assigned by the Ontario Ministry of the Environment.

THE GLENCOE SOUTHEASTERN WELL FIELD

Hydrogeology

The study area is a part of Ekfrid Clay Plain physiographic region (Chapman and Putnam, 1966).

Data from water well records in the area were used to delineate local lithology and hydrogeology which are illustrated in Figure 2. The overburden consists of more than 125 feet of lacustrine clay and hardpan which is considered to be an aquitard. Within the overburden, lenticular-shaped sand and gravel deposits occur which are of limited lateral extent and thickness. Situated near or immediately above the bedrock surface, these deposits are water-bearing and most of the wells in the area obtain water from this zone.

The overburden deposits are underlain by grey and black shale which belongs to the Hamilton Group of Formations of Paleozoic Age. Yields to wells in the shale bedrock are usually insufficient and water quality is commonly poor as the bedrock waters contain increased concentrations of chloride.

The geophysical logs (Appendix B) indicate that the casing in the Nagy drilled well terminates just a few feet above the bedrock surface in what has been interpreted as a deposit of sand, gravel and silt (Figure 2).

Figure 2 shows that both Glencoe municipal well No. 7 and the Nagy drilled well obtain water from the same hydrogeological unit, and from approximately the same depth. It is considered that good hydraulic communication exists between these 2 wells.

Description of Wells and Production

The Village of Glencoe owns a total of eight municipal wells located in the Village of Glencoe and surrounding area. Three of these wells are located in the vicinity of the Nagy drilled well and they comprise the Glencoe southeastern well field.

This well field consists of three wells designated as well Nos. 5, 6 and 7 (Figure 1) and all were drilled and put into production in 1964 and 1965 with pumping rate varying from 3 to 12 igpm (Beaty, 1971). The buried sand and gravel aquifer from which these wells obtain water occurs at depth between 105 and 127 feet below ground surface. Slotted casings have been installed in each well instead of conventional well screens.

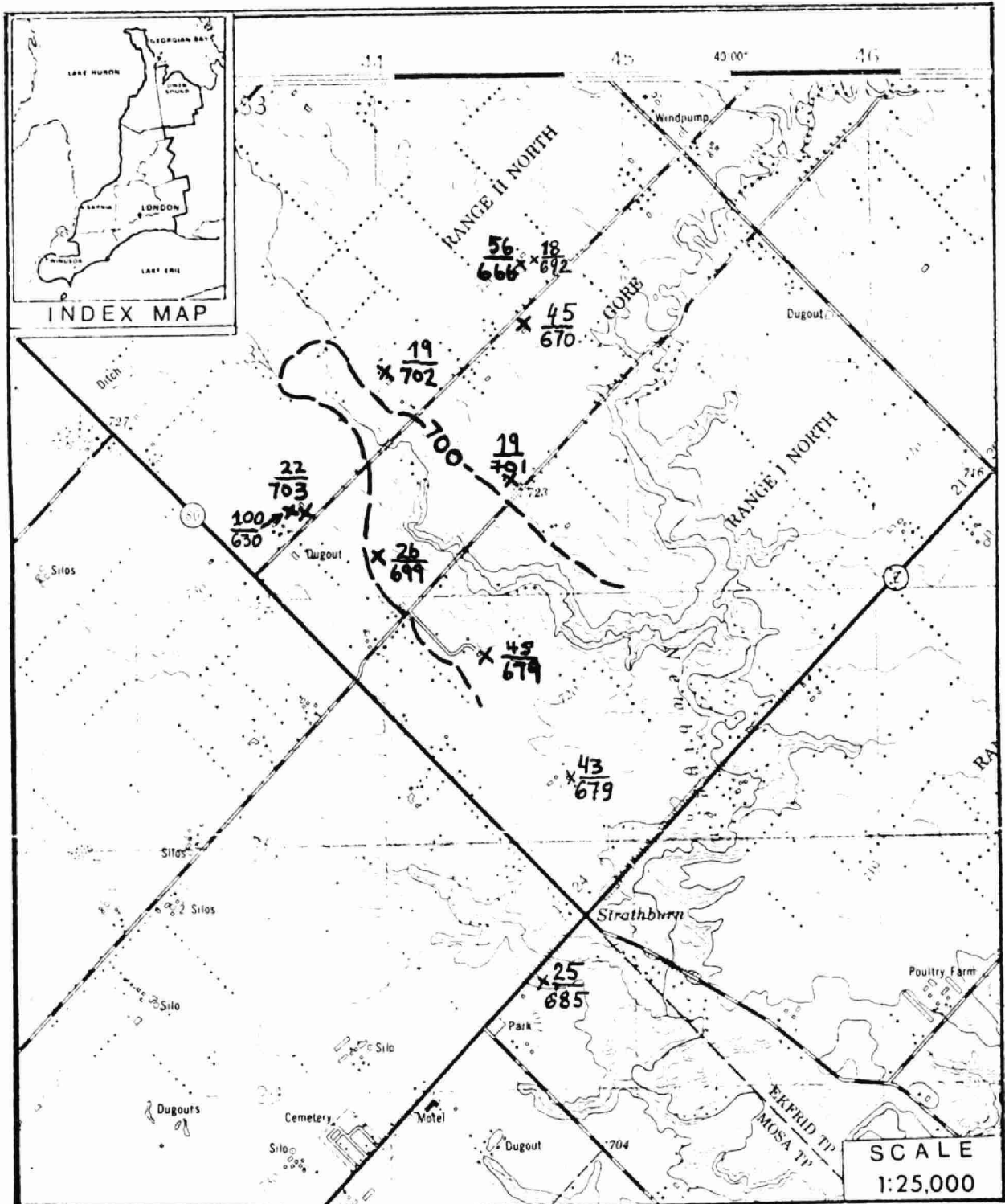
The original No. 5 well also constructed with slotted casing was abandoned in 1969, when it began to produce silt. It was replaced by a new No. 5 well (#4851) drilled only 12 feet away from the old well. Slotted casing was installed in this well too. The measured "static" water level in this well at time of its completion in September, 1969 was about 100 feet below ground surface. This reflects the drawdown of about 78 feet from the original static level, measured before the old municipal well No. 5 was put into production. This is an example of the severe lowering of the piezometric surface and of the mining of the buried sand and gravel aquifer which took place.

Available data indicate that the production from Glencoe municipal wells 5 and 6 was phased out at the end of 1971. However, well No. 7 continued to be in service periodically, and the latest available figures for pumpage from this well are for August, 1974, when the production rate was about 1200 gpd. It appears, however, that during 1975, municipal well No. 7 was periodically in operation but the rates of withdrawal and periods of operation are incomplete.

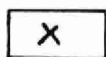
In the period from June 27 to July 2, 1975 the total pumpage from this well was 3589 gallons, which gives an average daily groundwater withdrawal of 720 gallons.

Impact of Groundwater Pumping

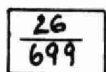
The depth to the original static water level of the buried sand and gravel aquifer in the area of the Glencoe southeastern well field was between 18 and 56 feet (Figure 3). Since the operation of this well field began, the hydraulic head of this aquifer has been gradually decreasing, with the creation of a large composite cone of depression. This situation has affected the Nagy drilled well, because the composite cone of depression has engulfed this well and considerably lowered the water level in it.



LEGEND

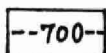


Control point



Depth to static water level in feet at time of well completion

Elevation of static water level in feet at time of well completion



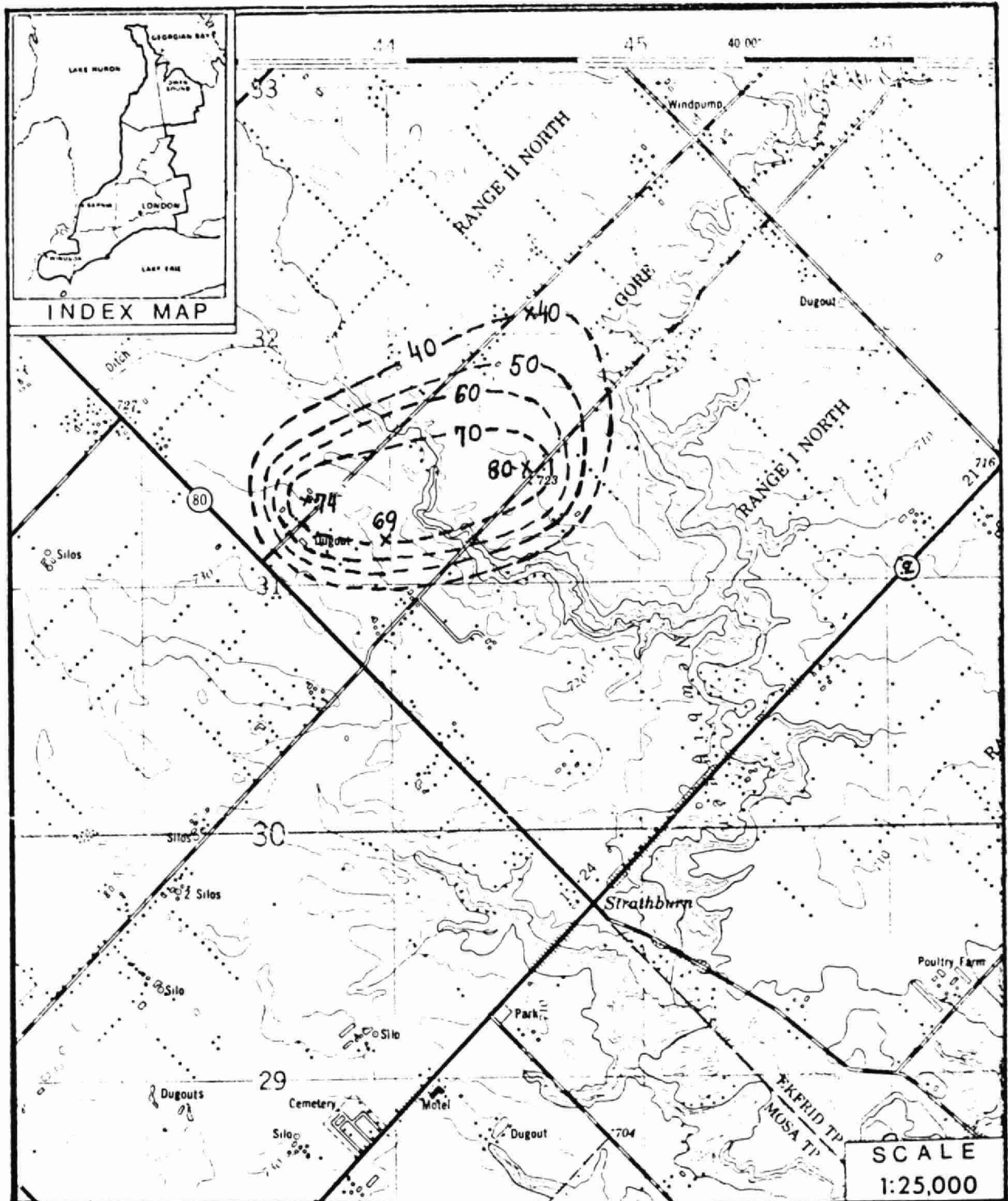
Line of equal hydraulic head

FIGURE 3. RECONSTRUCTED "ORIGINAL" PIEZOMETRIC SURFACE OF THE DEEP OVERBURDEN AQUIFER SYSTEM AT GLENCOE SOUTHEASTERN WELL FIELD

Table 1. Water levels in the Glencoe southeastern well field and the Nagy drilled well

Depth to water level below ground surface, in feet					
Date		Glencoe No. 5	Glencoe No. 6	Glencoe No. 7	The Nagy drilled well
1975					
June	23	96.5	94.9	93.5	
	27	96.5	94.9	100.0	
	28			100.5	
	29			100.8	
July	2			97.8	
	15			98.0	
	17			97.0	86.2
	22				
Sept.	11				84.8
Oct.	17		95.2	106.6	86.2
Nov.	20				86.0
Dec.	11	96.9	95.2	99.8	86.2
Jan.	30, 1976	95.4	93.4	95.3	
Mar.	26, 1976	96.7	93.6	87.5	83.4

Obviously, groundwater withdrawals by three Glencoe municipal wells has greatly exceeded natural recharge to the aquifer resulting in severe reduction of hydraulic head in the aquifer. Although the production from wells No. 5 and No. 6 was phased out at the end of 1971 and well No. 7 was only periodically in production during 1975, the groundwater recovery is extremely slow. This is because the permeability of overlying lacustrine clay and hardpan through which aquifer recharge occurs is poor. Measured depths to water levels in these wells in 1975 and 1976 are indicated in Table 1.



L E G E N D

- x 69** Control point with total hydraulic pressure drawdown, in feet
- 50--** Line of equal hydraulic pressure drawdown, in feet

FIGURE 4. CONTOUR MAP OF THE COMPOSITE HYDRAULIC PRESSURE DRAWDOWN OF THE DEEP OVERBURDEN AQUIFER SYSTEM AT GLENCOE SOUTHEASTERN WELL FIELD (JUNE 27, 1975)

The composite cone of depression created by the operation of the Glencoe southeastern well field is shown in Figure 4. In constructing this cone of depression, hydraulic connection between pumping centers was assumed. Although it is apparent that the composite cone is extensive, it should be pointed out that the relative positions of lines of equal drawdown shown in Figure 4 are approximate because of insufficient data. This is the reason why no zero drawdown contour was drawn.

CONCLUSIONS AND RECOMMENDATIONS

Based on field study, and analyses of available geologic and hydrologic data it is concluded that:

1. The Glencoe municipal wells which comprise the Southeastern well field and the Nagy drilled well obtain water from the same buried sand and gravel aquifer at depths between 105 and 124 feet. This aquifer has limited lateral extent and thickness and recharge is slow occurring in the form of vertical leakage through relatively thick confining lacustrine clay and hardpan.
2. Groundwater withdrawals by the Glencoe municipal wells have created a relatively large composite cone of depression (severe lowering of the piezometric surface) in the buried sand and gravel aquifer. This has caused severe lowering of the water level in the Nagy drilled well which is within the cone of depression.

3. The Permit To Take Water from Glencoe municipal well No. 7 (Permit No. 65-P-18) issued by this Ministry to Glencoe P.U.C. contains an interference clause which spells out the responsibilities of the Permittee in this situation.

It is therefore recommended that the Village of Glencoe restore Mr. Nagy's domestic water supply which has been affected by the operation of Glencoe municipal well No. 7. Since there remains about 60 feet of available drawdown in the Nagy drilled well, the pump intake should be placed at a depth of about 135 feet. The labor and additional material costs required to fully restore the water supply should be paid by the Village of Glencoe.

Finally, the yield required by Mr. Nagy from this well should be determined since it may be that the well may not, by reason of decreased available drawdown and poor yield be capable of meeting his needs. If this proved to be the case, then the restoration could be accomplished by utilizing one of the municipal wells together with the Nagy well.

REFERENCES

Beatty, B.W. and Nunan, J. P., 1971. Report on evaluation of municipal water wells and the availability of groundwater at Glencoe. Hydrology Consultants Limited, Mississauga.

Chapman, L.J. and Putnam, D.F., 1966. The physiography of Southern Ontario. The University of Toronto Press, second edition.

Ontario Ministry of the Environment, 1971-1975. File on complaint of domestic well interference G. Nagy vs. Village of Glencoe. Southwestern Region, London.

Small, E.C., 1971. Report on complaint of well interference Mr. G. Nagy vs. Glencoe Public Utilities Commission. Ontario Water Resources Commission.

SUMMARY OF WATER WELL RECORDS

APPENDIX A

SUMMARY OF WATER WELL RECORDS

COUNTY: MIDDLESEX

TOWNSHIP(S): EKFRID

DATE COMPILED: DEC '75 COMPILER: K. LYON

WELL NO.	LOCATION			ELEV. (FT.)	OWNER	DRILLER	DATE DRILLED	WELL TYPE	WELL DIA. (IN.)	WELL DEPTH (FT.)	WATER FOUND (FT.)	STATIC LEVEL (FT.)	PUMPING TEST			WATER TYPE	LOG AND REMARKS
	TWP.	LOT	CON.										DRAW-DOWN (FT.)	G.P.M.	HRS.		
5548		22	RANGE II NORTH	705	F. PARSONS	EARL & LATHER	08/71	9	4	161	160	56	34	4	3	SALTY	sand with stones 2, packed red clay 16, soft grey clay 115, hardpan with stones 142, grey shale 161
5929		22	RANGE II NORTH	710	A. PETERSON	C. HAYDEN	07/72	0	36	80	16	18	62	?	?	FRESH	sand 4, packed brown clay 16, packed blue clay 80
764		23	RANGE II NORTH	700	S. KERKAS	R. DOLPHIN & T. EARL	08/64	9	4	155	140	19	121	2	1	FRESH	yellow clay 15, blue clay 100, hardpan 125, grey top rock 155
662		22	GORE	700	G. NAGY	HADCO WELL DIGGING	10/65	0	30	65	9, 55	10	?	?	?	FRESH	sandy clay 3, brown sand 7, grey sand 10, blue clay 55, sandy clay 65
4851		24	RANGE II NORTH	725	GLENCOE PUC	EARL & LATHER	09/69	9	6	142	108	100	0	12	12	FRESH	packed red clay 15, dense grey clay 95, soft grey clay with sand 107, hardpan with clay, stones, sand 124, cemented grey clay with stones 135, grey shale 142
765		24	RANGE II NORTH	725	L. CSOMBOK	M. GOUGH	05/50	0	4	105	105	25	15	30	1	FRESH	clay 70, quick sand 100, firm gravel 105
766		24	RANGE II NORTH	725	GLENCOE PUC	R. DOLPHIN & T. EARL	08/64	0	7	115	105	22	10	24	9	FRESH	yellow clay 15, blue clay 85, hardpan 110, gravel 115
663		23	GORE	700	GLENCOE PUC	R. DOLPHIN & T. EARL	08/64	0	7	121	114	19	13	30	24	FRESH	yellow clay 15, blue clay 75, hardpan 114, gravel 121
664		24	GORE	715	GLENCOE PUC	R. DOLPHIN & T. EARL	08/64	0	7	110	105	26	10	30	40	FRESH	yellow clay 15, blue clay 70, hardpan 105, gravel 110
5234		24	RANGE I NORTH	705	L. CAMPBELL	S. EARL	10/70	9	4	176	DRY	—	—	—	—	—	sand 7, blue clay 143, hardpan with stones 151, black shale 156, grey shale 176
5235		24	RANGE I NORTH	700	L. CAMPBELL	S. EARL	10/70	9	4	214	DRY	—	—	—	—	—	sand 5, blue clay 140, hardpan with stones 150, grey shale 214

* 9 well drilled into bedrock 0 well drilled in overburden

SUMMARY OF WATER WELL RECORDS

COUNTY: MIDDLESEX

TOWNSHIP(S): EKFRID AND MOSA

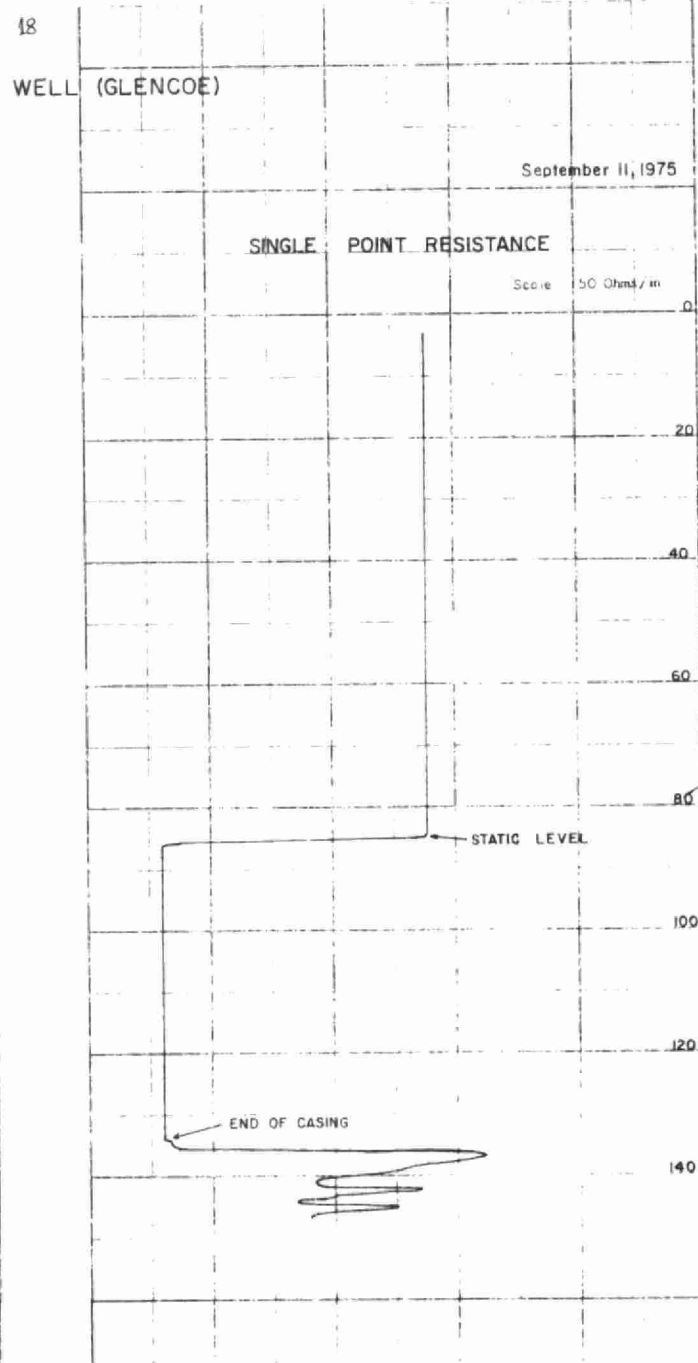
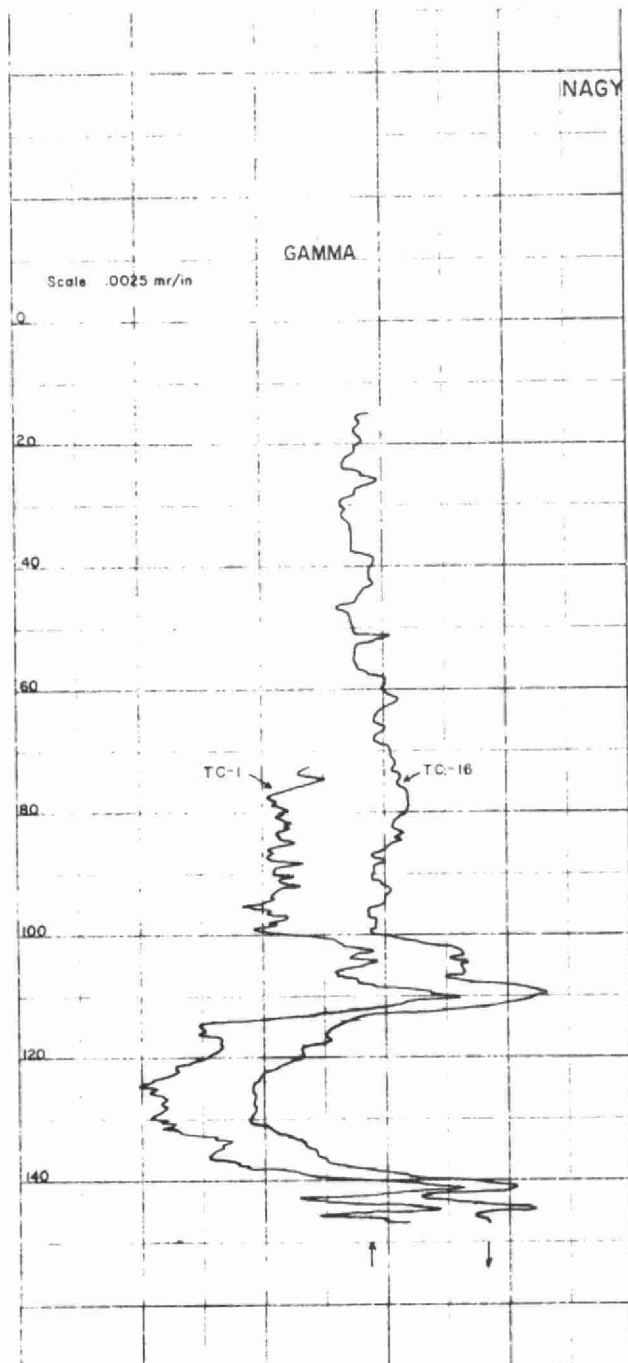
DATE COMPILED: DEC '75 COMPILER: K. LYON

WELL NO.	LOCATION			ELEV. (FT)	OWNER	DRILLER	DATE DRILLED	WELL TYPE	WELL DIA. (IN.)	WELL DEPTH (FT)	WATER FOUND (FT)	STATIC LEVEL (FT)	PUMPING TEST			WATER TYPE	LOG AND REMARKS
	TWP.	LOT	CON.										DRAW-DOWN (FT)	G.P.M.	HRS.		
5236	E	24	RANGE I NORTH	705	L. CAMPBELL	S. EARL	10/70	9	4	167	150	49	101	1/6	12	FRESH	sand 6, blue clay 139, hard pan with stones 150, grey shale 167
5161	E	24	RANGE I NORTH	710	L. CAMPBELL	S. EARL	07/70	9	4	168	139	45	55	3/4	10	FRESH	sand 5, blue clay 134, gravel with sand 139, hard pan with stones 146, black shale 168
5162	E	24	RANGE I NORTH	710	L. CAMPBELL	S. EARL	07/70	9	6	173	DRY	—	—	—	—	—	sand 7, blue clay 137, hard pan with stones 154, black shale with grey shale 173
5328	E	24	RANGE I NORTH	705	F. ALEX	W. MARSH	01/71	0	5	123	119	43	7	4	12	FRESH	sand 2, brown clay 40, grey clay with stones 119, sand and gravel 123
5557	M	1	RANGE I SOUTH	705	MINISTRY OF ENVIRONMENT	CORALTA DRILLING	07/71	9	6	220	127	25	85	45	5	FRESH	brown clay 5, gray clay 12, gravel 13, gray clay 17, green clay (sticky) 77, gravel 78, sticky green clay 101, gravel 103, boulder 104, green clay 105, boulder 108, gravel seam with clay 118, stick brown sand 128, coarse gravel 136, coarse sand 137, gravel 146, sticky green clay 194, green shale 197, green clay 213, shale 217, green clay 220

* 9 Well drilled into bedrock 0 Well drilled in overburden

GEOPHYSICAL LOG OF THE NAGY DRILLED WELL

APPENDIX B



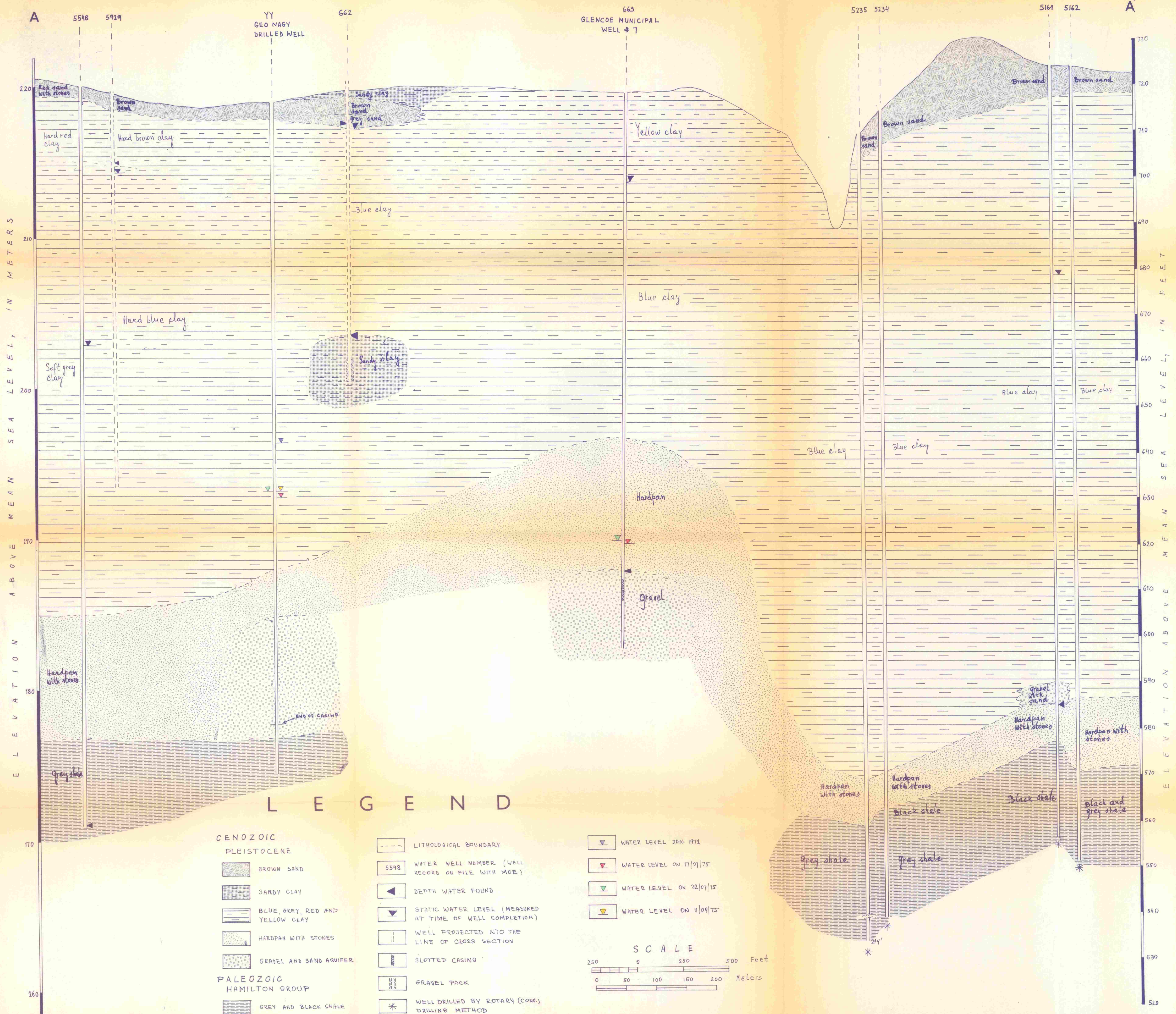


FIGURE 2. GEOLOGICAL CROSS SECTION SHOWING VARIATION OF HYDROGEOLOGICAL ENVIRONMENTS AT GLENCOE SOUTH-EASTERN MUNICIPAL WELL FIELD.

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Investigation of
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